New architecture for optical fiber networks proposed

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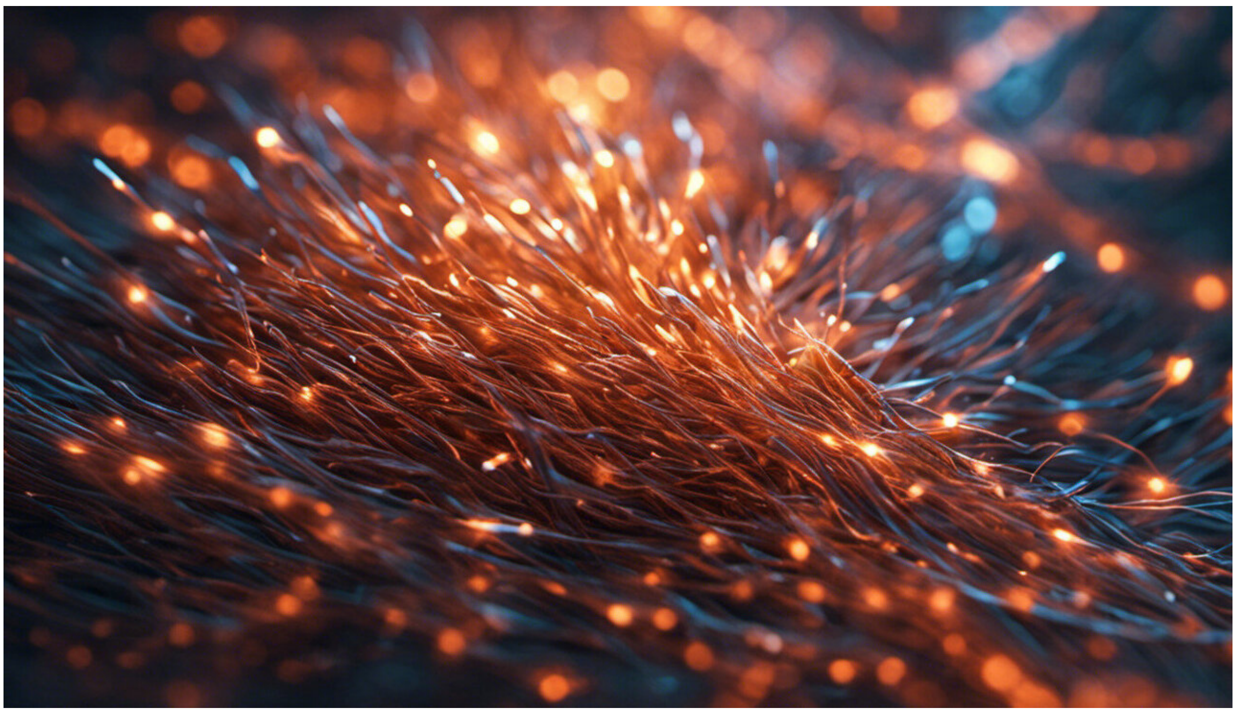

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The household demand for increased internet bandwidth has grown tremendously because of the popularity of data-intensive internet activities such as movie streaming. Conventional copper telephone lines struggle to meet this demand, and modern optical fiber networks connecting the homes of consumers to the network backbone are becoming necessary. Jing Zhang and co-workers at the ASTAR Institute of Microelectronics have now demonstrated a network scheme that considerably reduces the cost of fiber-optic installations and could make them more attractive for consumer use.

A key component of any optical fiber network is the laser that transmits information down the fiber. Unlike the silicon-based electronic circuits that control the data flow through the network, these lasers are made from semiconductor materials other than silicon, which is a poor light-emitter. This makes integrating lasers with silicon electronic circuits cumbersome and expensive, and so reducing the number of lasers in the network could substantially lower the cost of connecting users to the internet.

One widely adopted scheme for reducing the number of expensive lasers in the network is to transmit data to multiple homes at once using a single laser, with a transmission protocol ensuring that the correct data packet is sent to the correct user. Yet although this configuration reduces the number of lasers considerably, each connected household still needs a laser to send data back the other way.

The network architecture proposed by Zhang and his co-workers eliminates the laser at the consumer end. Instead, they propose using two strands of optical fiber: one to transmit data to the consumer as usual and another to send a continuous laser beam to all linked consumers. An integrated silicon chip at the consumer end picks up the incoming continuous laser beam, encodes it with the signal intended for back transmission, and then redirects this laser beam back to the internet provider. “Fiber is cheaper than lasers, particularly as it can be used for more than 20 years once it is installed,” says Zhang.

In their experiment, the researchers also demonstrated the practical viability of this scheme for the operation of commercial fiber-optic networks. They fabricated an integrated silicon circuit for this task and have already achieved successful operation at speeds of up to 10 gigabits per second. “Given the cost benefits, these transceiver devices may significantly accelerate the deployment of optical fiber networks,” says Zhang. “Our work has attracted serious commercial interest for collaboration on the development of silicon photonic transceivers.”

More information: Zhang, J., et al. 10Gbps monolithic silicon FTTH transceiver without laser diode for a new PON configuration. *Optics Express* 18, 5135–5141 (2010). dx.doi.org/10.1364/OE.18.005135

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